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Description of a new species of Agonidæ (*Brachyopsis verrucosus*), from the coast of California. By W. N. Lockington. 8vo, pp. 9, 1880. From the author.

Observations on Mount Etna. By S. P. Langley. (From the Amer. Jour. Sci. and Arts, Vol. XIX, July 1880.) 8vo, pp. 12, 1880. From the author.

Introduction to the Study of Mortuary Customs among the North American Indians. By Dr. H. C. Yarrow. 4to, pp. 6, 114, 1880. From the author.

Contributions to the Archæology of Missouri. By the Archæological Section of the St. Louis Academy of Science. Pt. I.—Pottery. 4to, pp. 30, maps 5, pl. 24, 1880.

Memoirs of the Geological Survey of India. Series x. Indian Tertiary and Post-Tertiary Vertebrata. Vol. I, pt. iv.—Supplement to Crania of Ruminants, pp. 172–181, pl. 21–24. Pt. v.—Suvalik and Marbada Proboscidea, pp. 182–300, pls. 29–45. By R. Lydekker. From the author.

The Valley Naturalist. Vol. ii, No. 1, 8vo. St. Louis, 1880. From the editor.

The Student. Vol. I, No. 1, 8vo, 1880. From the editors.

Palæontographica. Beiträge zur Naturgeschichte der Vorzeit. 4to, pp. 88, pl. 11. Cassel, 1880. From the editors.

Beiträge zur Kenntniss der Flussfische Südamerika's. Von Dr. Franz Steindachner. 4to, pp. 23, pl. 4, 1880. From the author.

Ueber den geologischen Ban der libyschen Wüste. Von Dr. Carl A. Zittel. 4to, pp. 47, map 1, 1880. From the author.

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GENERAL NOTES.

BOTANY.

THE FERTILIZATION OF *AQUILEGIA VULGARIS*.—A note by Mr. Thomas Meehan, in the "Bulletin of the Torrey Club" for June, 1880, recording the perforation of the curved spurs of certain species of columbine, induces the publication of the following article, based chiefly on the observations of Sprengel¹ and Dr. H. Müller.²

As the plant commonly grows, the flowers are pendant. The five sepals are petaloid, nearly flat, and aid in rendering the flowers conspicuous. Each petal is somewhat funnel-shaped at its base, but quickly narrows into a slender tube 15–22 mm. in length, which is bent inward and downward at about 5 mm. from its free end, nectar being stored in the portion beyond the bend, where it is secreted by a glandular thickening of the wall.

The pendant position of the flower renders it inconvenient for lepidoptera to obtain the nectar, for if they would do so they must hang from the lower part of the flower, since their proboscides flex readily only in a ventral direction; and this position is not always to their liking. The length of that portion of the spur lying below the bend is a sufficient protection against the removal of nectar by bees with short tongues, and the curvature seems to be a pretty good way of excluding birds, which, as Prof. Todd has shown,³ and as I have observed during the past spring, visit the flowers of our native *Aquilegia canadensis*. Thus it

¹ Entdeckte Geheimniss, 1793. S. 279.

² Befruchtung der Blumen, 1873. S. 118.

³ AM. NATURALIST, Sept., 1880, p. 668.

appears that the nectar of these flowers is perfectly accessible only to insects whose slender and flexible suctorial mouth-parts reach a length of not less than 10 mm.; and these insects must be habituated to hanging upon flowers while probing them for their sweets. These requirements are met with only in certain humble bees. Sprengel records the flowers as being visited for their nectar normally, and fertilized, by large humble bees. Dr. Müller, from observations extending over a number of years, finds two species of *Bombus* which act in this way; the first, *B. hortorum*, has a tongue reaching a length of from 19–21 mm.; the second, *B. agrorum*, has a tongue varying from 12–15 mm. in length. When collecting nectar, one of these bees hangs upon the flowers with its prothoracic legs on the base of a spur, the mesothoracic and metathoracic limbs clinging to the column formed of the stamens and pistils. Inserting its head as far as possible into the flaring mouth of the nectary, it passes its tongue into the spur, the curve of which is readily followed when the insect occupies this position, in which the ventral surface of its body is brought in contact with the essential organs. But the flowers are proterandrous, the anthers only being mature in young flowers, while they are replaced by the receptive stigmas in older ones; so the bees, going from plant to plant, constantly cross older flowers with pollen from those which are younger, and, from their habit of visiting the lower (and older) flowers of a plant first, they usually cross the flowers of distinct plants. Where the nectar has been removed from flowers, the bees soon learn to probe only a single spur, and finding this empty, seem to reason that it would be a useless waste of time to try the others, and hasten on to another flower. Many years ago Necker proved the value of these nectaries for the fruiting of the flower, for he found that no fruit was set after their removal; but he does not seem to have arrived at the correct explanation of the result of his experiment.¹

Concerning the perforation of the spurs of the corolla, Sprengel tells us that he found hive bees (? Bienen) on the flowers, which first collected pollen, then betook themselves to the bend in the spurs, which they bit through, thus readily obtaining the nectar. Dr. Müller found two small wild bees—species of *Halictus*—collecting pollen from the open anthers, but they showed no tendency to obtain nectar, and hive bees trying, failed. He found, however, that an humble bee (*Bombus terrestris*), having a tongue not exceeding 9 mm. in length, and therefore debarred from partaking of the sweets with its more fortunate relatives, seemed to learn by individual experience the futility of attempting to reach the nectar in the normal way, afterwards acquiring the habit of

¹Acta Academiæ Theodoro Palatinæ, v (*vide* Senebier). Soyer-Willemet also observed the same fact, and advances it on p. 13 of his "Mémoire sur le Nectaire" in support of his theory that nectar played a direct rôle in the act of fecundation.

alighting on the hook of the nectaries and perforating them on the convex side, securing their prize through the opening thus formed.

It is well known that one or more of our sixty-two North American species of *Bombus* habitually perforate flowers whose nectar is inaccessible to them normally; and from the shortness of the spurs of certain flowers like *Dicentra canadensis* and *D. cucullaria*, which, as every lover of our spring flowers must have noticed repeatedly, are invariably disfigured in this manner in some localities, it is to be inferred that some of these bees have very short tongues, though I am not aware that the species have ever been carefully compared in this respect. The individuals that Mr. Meehan found perforating columbines, in all probability did not possess tongues sufficiently long to enable them to obtain the nectar in the regular way.

While, therefore, *Aquilegia vulgaris* is visited normally to a certain extent by hive bees, small wild bees and short-tongued humble bees, which either in gathering pollen or trying to obtain nectar must, necessarily, aid in the cross-fertilization of the flowers, it seems perfectly adapted to profit by the visits of the long-tongued species of *Bombus*, and I must therefore depart from the conclusions of Mr. Meehan, that "the humble bee and the honey bee are evidently not the insects for which the *Aquilegia* had this beautifully contrived nectar cup provided to induce cross-fertilization, and what particular insect was designed to be the favored one, so that it and no other could turn its tongue around these twisted spurs to get at the honey in the end, I think no student has discovered," so far as to believe that the evidence in the case warrants the conclusion that certain species of "the humble bee" are evidently the insects for which the *Aquilegia* had its beautifully contrived nectar cup provided to induce cross-fertilization.—*William Trelease*.

PLANTS OF NOVA SCOTIA, CAPE BRETON AND NEW FOUNDLAND.
—The following list of plants represent the results of herborizing in an interesting region:

Thalictrum cornuti L., Torbay, N. F.

Ranunculus hyperboreus Roth., Open Hall, N. F. In black mud.

" *repens* L., Guysborough, N. S.

" *acris* L., Guysborough, N. S.

Sarracenia purpurea L., Arichat, Cape Breton island.

Diosera rotundifolia L., at Arichat, with *S. purpurea* L., and *Calopogon pulchellus* R. Br., in moist moss, and at Open Hall, N. F.

Stellaria media Smith, Guysborough, N. S., Torbay, N. F.

" *longifolia* Muhl., Torbay, N. F.

" *uliginosa* Murr., Torbay, N. F.

Cerastium viscosum L., Torbay, N. F., Guysborough, N. S.

Malva moschata L., Guysborough, N. S. Both the white and the purple-flowered forms common on roadsides.

Oxalis acetosella L., Guysborough, N. S.

Spiraea salicifolia L., Open Hall, N. F.

Poterium canadense L., Cape Broyle, N. F.

Potentilla norvegica L., Carbonier, N. F.

- Potentilla tridentata* Ait., Arichat, Cape Breton island. Extremely numerous over the treeless barrens above the village.
- Fragaria vesca* L. ? Arichat, Cape Breton island.
- Rubus triflorus* Richards, Arichat, Cape Breton island.
- “ *villosus* Ait., Torbay, N. F.
- Rosa lucida* Ehr., Carbonier and Open Hall, N. F.
- Cicæa alpina* L., Guysborough, N. S. This and *Oxalis acetosella* L., occur in enormous numbers over the moist shady hillsides in the vicinity of Guysborough.
- Epilobium angustifolium* L., Guysborough, N. S., Cape Broyle, N. F.
- “ *coloratum* Muhl., Torbay, N. F.
- Oenothera fruticosa* L., Guysborough, N. S.
- “ *chrysantha* Mx.
- Heracleum lanatum* Mx., Torbay, N. F.
- Carum carui* L., Guysborough, N. S. Escaped and become a very troublesome weed in meadows.
- Aralia nudicaulis*, L., Cape Broyle, N. F.
- Cornus canadensis* L., Guysborough, N. S.; Arichat, Cape Breton island, and Cape Broyle, N. F. Very abundant.
- “ *stolonifera* Mx., Cape Broyle, N. F.
- Linnaea borealis* Gronov., Cape Broyle and Bay of Bulls, N. F. Forming very dense mats on the exposed rocky hillsides.
- Viburnum nudum* L., Cape Broyle, N. F.
- Galium asprellum* Mx., Guysborough, N. S.; Torbay, N. F.
- “ *trifidum* L., Arichat, Cape Breton island.
- Aster æstivus* Ait., Cape Broyle, N. F.
- “ *lævis* L., Cape Broyle, N. F.
- “ *memoralis* Ait., Open Hall, Bay of Bulls, N. F.
- “ *purnucceus* L., Cape Broyle, N. F.
- Diplopappus umbellatus* Torr. et Gr., Cape Broyle, N. F.
- Solidago thyrsoides* E. Meyer, Cape Broyle, N. F.
- “ *altissima* L., Cape Broyle, N. F.
- Achillea millefolium* L., Torbay, N. F.
- Senecio vulgaris* L., Torbay, Cape Broyle, N. F.
- Centaurea nigra* L., Torbay, N. F.
- Leontodon autumnale* L., Guysborough, N. S.
- Nabais nanus* D. C., Torbay, N. F.
- Campanula rotundifolia* L., Torbay, N. F.
- Vaccinium canadense* Kalm., Cape Broyle, N. F.
- “ *macrocarpum* Ait., Arichat, Cape Breton island.
- “ *oxycoccus* L., Arichat, Cape Breton island.
- “ *pennsylvanicum* Lam., Cape Breton island.
- “ *vitis-idaea* L., Open Hall, N. F.
- Chiogenes hispidula* Torr. et Gray, Guysborough, N. S.
- Kalmia angustifolia* L., Arichat, Cape Breton island; Cape Broyle, N. F.
- Ledum latifolium* Ait., Cape Broyle, N. F.
- Pyrola elliptica* Nutt., Guysborough, N. S.
- “ *secunda*, Open Hall, N. F.
- Plantago maritima* L., Guysborough, N. S.
- Trientalis americana* Pursh., Cape Broyle, N. F.
- Lysimachia stricta* Ait., Guysborough, N. S.
- Veronica chamaedris* L., Guysborough, N. S. Found quite abundant in a shady ravine.
- “ *serpyllifolia* L., Torbay, N. F.; Guysborough, N. S.
- Euphrasia officinalis* L., Guysborough, N. S.; Arichat, Cape Breton island.
- Rhinanthus christa-galli* L., Guysborough, N. S.; Cape Broyle, N. F.
- Melampyrum americanum* Mx., Arichat, Cape Breton island.
- Lycopus virginicus* L., Bay of Bulls, N. F.
- Brunella vulgaris* L., Arichat, Cape Breton island.
- Scutellaria galericulata*, Guysborough, N. S.
- Galeopsis tetrahit* L., Open Hall, N. F.
- Myosotis verna* Nutt., Torbay, N. F.
- Ipomoea pandurata* Meyer, Guysborough, N. S.

Urtica dioica L., Torbay, N. F.
Juniperus communis L., Bay of Bulls, N. F.
Larix americana Mx., Bay of Bulls, N. F.
Habenaria lacera R. Br., Guysborough, N. S.
Goodyera repens R. Br., Open Hall, N. F.
Spiranthes romanzoviana Cham., Carbonier, Cape Broyle, N. F.
Calopogon pulchellus R. Br., Arichat, Cape Breton island.
Juncus effusus, Arichat, Cape Breton island.
Carex rostrata Mx., Arichat, Cape Breton island.
 “ *vulgaris* Fries, Arichat, Cape Breton island.
Agrostis vulgaris With., Cape Broyle, N. F.
Festuca ovina L., Redcliffe island, N. F.
Poa annua L., Guysborough, N. S.
 “ *debilis* Torr., Cape Broyle, N. F.
Aspidium spinulosum Suz., Cape Broyle, N. F.
Lycopodium annotinum L., Bay of Bulls, N. F.

—Henry L. Osborn.

BOTANICAL NOTES.—The new “students’ garden” at Kew is an excellent design, well calculated, if properly cared for, to foster a knowledge of botany, and excellently adapted to impart an idea of what botany means to the many thousands of visitors who make excursions to the gardens. The *Gardeners’ Chronicle* has recently advocated the establishment of “school gardens,” where practicable, and we see no reason why they should not be established wherever there is a public park. In several continental countries they can be counted by hundreds, and in the country of Linnæus by thousands.—In a recent paper on the impurities of drinking water caused by vegetable growths, published by Prof. W. G. Farlow in the first annual report of the Massachusetts Board of Health, attention is especially called to the Nostoc group. These bluish-green algæ so long as they are living and not excessively abundant, produce no perceptibly bad effect on the water, but when they decay in large quantities they give rise to the pigpen odor, as it is called, which has in recent years caused considerable trouble and still more alarm. The water thus affected becomes too offensive to drink, and cannot be entirely purified by filtering. No absolute remedy is suggested or probably can be, but ponds should be cleared of weeds and substances in which the nostocs may lodge and develop, and the water in the pond should not be allowed to fall rapidly. One of the two plates illustrates the harmless desmids, etc., and the second the injurious nostocs.—It appears that the Ningpo hats, of which 15,000,000 were exported in 1877, many being sold in the Southern United States, are made from a sedge, *Cyperus tegetiformis*.—The development of the colors of flowers is discussed by Dr. Hermann Müller in *Kosmos*.

ZOÖLOGY.¹

A RELATION BETWEEN METEOROLOGY AND THE GRASSHOPPER OR LOCUST PEST.²—In the winter of 1877-1878 I made a short

¹ The departments of Ornithology and Mammalogy are conducted by Dr. ELLIOTT COUES, U. S. A.

² Read before the National Academy of Sciences.